Agro Services International Inc.

Controlling nitrate pollution of groundwater

By Dr. Terrence Fullerton

It is often assumed that the majority of nitrates found in groundwater are due to the use of fertilizers. This is not necessarily true; high groundwater nitrates have been found in many areas where fertilizer use was not a factor.

There are other sources of nitrates including the use of organic manure and the disposal of domestic waste. The release of nitrates by organic matter during periods when crops are not actively growing is often a major source of groundwater nitrates.

Even though fertilizers are not the only source of nitrates in groundwater, they do contribute to the problem. Nitrate loss from applied fertilizer is not only an environmental problem, but is also an economic one as the crop is not using the fertilizers that were applied.

The solution to the problem is, in principle, quite simple. We must get the crop to use the applied nitrogen. If all the fertilizer is taken up by the crop, there will be none left to be leached into the groundwater. Unfortunately, this is easier said than done.

Crop uptake of applied nitrogen has been researched more than any other plant nutrition issue, but it remains one of the biggest technical problems in soil science. In spite of our best efforts, crops generally take up no more than 50 per cent of the fertilizer nitrogen and little remains in the soil for the next crop.

It should not be assumed that the other 50 per cent is leached into the ground water. There are numerous other ways by which the nitrogen is lost, including volatilization, runoff and denitrification. In practice, the extent to which any of these processes occur is difficult to predict and depends on environmental conditions.

Whatever the mechanism by which the nitrogen is lost, it is necessary to reduce it by maximizing crop uptake.

Methods to increase crop nitrogen uptake and reduce nitrate leaching.

Apply no more nitrogen than is needed.

This is a simple rule that is well understood by growers. However, predicting the exact amount needed is often difficult.

Apply small, regular doses.

Nitrogen does not remain in the soil for more than a few weeks. If a high dose is applied at once, the plant uses only a small part of it and the remainder is lost. Small, regular applications are far more effective especially if the applications are timed to suit the periods of maximum crop uptake.

Ensure that plants are capable of using the applied nitrogen.

Nitrogen is guaranteed to be lost if it is applied to plants that cannot use it. Any problem in the field that restricts plant growth will reduce nitrogen uptake and increase its loss. In this situation, farmers often respond by applying higher doses of nitrogen making the problem worse. Proper agronomic practices are therefore an essential part of controlling nitrate pollution.

Balanced nutrition is a critical component of proper agronomic practices. A deficiency in any of the other essential nutrients will limit crop growth and thus reduce the nitrogen uptake. A proper system of soil analysis and balanced fertilization is necessary to predict and prevent these nutrient problems.

Fertilizer selection.

There is little to be gained by using non-nitrate fertilizers. All nitrogenous fertilizers are converted into nitrates by soil bacteria within a short period, typically 2 weeks. Nitrogen from organic matter is also converted into nitrates in the soil. There are several fertilizers designed to release nitrogen at the same rate at which the crop uses it. These slow-release materials are very effective but are relatively expensive.

Chemical Inhibitors

Several chemicals are used to modify the rate at which nitrogen transformations occur in the soil so that the plants have a better chance of taking the nutrient up. Urease inhibitors slow the conversion of urea to ammonium nitrogen, nitrification inhibitors slow the conversion of ammonium nitrogen to nitrates that can be easily leached. These products are relatively new and are not commonly used at this time.

205 East Michigan Avenue
Orange City, Florida, 32763-2332
Tel 386 775 6601 Fax 386 775 9890
E-mail agro@agroservicesinternational.com
www.agroservicesinternational.com